

Influence of 3D manipulation in actual, augmented, and virtual reality on the cognitive load while changing representations in modelling chemical structures

Abstract for the general public

Have you ever felt overloaded by a task? It can happen when your working memory is overloaded. In general, the process of how we learn is when the information is transferred from the working memory to the long-term memory. The process is called cognitive load. As we can see from our own experience, memory has its capacity. When we receive too much information, our memory cannot process it. That causes an overload of memory and when we learn, we do not want to experience this. Therefore, the learning materials should be created to avoid cognitive overload. Modern methods allow us to measure the cognitive load while solving some tasks. It is for example measuring the heart rate (HR) or measuring the brain's activity by electroencephalography (EEG) measurements. Chemistry is considered as difficult because it involves changing representations between simple summary formulas to complex 3D molecules. Do you feel the same when you think about chemistry?

In our research, we want to measure the cognitive load during solving tasks. Students will be taught the same topic of chemistry (chemical structures) using different methods (computer apps, augmented reality, virtual reality, drawing in 3D with 3D pens). Then, they will solve tasks. During the tasks, measurements will be done (via HR and EEG). Results from these measurements would help us to say, which educational technologies are more effective and whether teachers should use computer apps, augmented reality, virtual reality, or 3D pens during their teaching. That means it would help us to improve the learning environment, materials, and strategies. The problem of changing representation is present not only in chemistry but also in some extent in physics, biology, and mathematics. Therefore, the results will be universal and widely recognized.

So, let's go and learn more effectively!

